STRUCTURAL EQUATION MODELING OF INFLAMMATION RESPONSE TO SHORT-TERM LOCAL TRAFFIC POLLUTION EXPOSURE

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Background and Aims: Some epidemiological studies have reported conflicting results on the effect of traffic-related pollutants on markers of inflammation. An alternative approach is proposed to comprehensively interpret study results and to help advance our understanding of air pollution-mediated biological impacts on inflammation. In a Bayesian framework, we examined the effect of local traffic pollution on inflammation using structural equation models (SEMs).
Methods: We studied measurements of C-reactive protein (CRP), soluble vascular cell adhesion molecule-1(sVCAM-1), and soluble intracellular adhesion molecule-1(sICAM-1) on 816 elderly men from the Normative Aging Study. Using SEMs, a latent variable for local traffic pollution that is reflected by levels of black carbon, CO, NO, and NO_2 was fit to estimate its effect on a latent variable for inflammation that included sICAM-1, sVCAM-1 and CRP. Exposure periods were assessed using 1-, 2-, 3-, 7-, 14-, and 30-day moving averages pre-visit. We compared our findings using SEMs with those obtained using Bayesian linear mixed models.
Results: Local traffic pollution was related to increased inflammation. Results from structural equation modeling showed that a 1 $\mu g/m^3$ increase in local traffic pollution (reference pollutant: BC) exposure was associated with an 8.2% (95% posterior interval (PI), 1.6–15.5%) and 16.3% (95% PI, -2.0–37.8%) increase in mean of inflammation (reference marker: sVCAM-1) 1 and 7 days later, respectively. Additionally, in linear mixed modeling, the percentage change in mean of sVCAM-1 per 1 $\mu g/m^3$ increase in black carbon pollution was also associated 1 [6.4% (95% PI, 3.1–9.9%)] and 7 [9.2% (95% PI, 2.5–16.0%)] days later. Furthermore, results from the SEMs gave consistent larger effect estimates and wider PI than results from the linear mixed models.
Conclusions: Local traffic pollution adversely impacts inflammation in the elderly. Structural equation modeling may be an alternative approach in air pollution-cardiovascular epidemiological studies.